What is claimed is:

1   1.   A method for analyzing a sample of wafers, comprising the steps of:

2   (a)   identifying F failure metrics that are applicable to at least one circuit pattern on each

3   wafer within the sample of wafers, where F is an integer;

4   (b)   identifying Z spatial and/or reticle zones on each wafer, where Z is an integer;

5   (c)   providing values for each of the F failure metrics, for each of the Z zones on each

6   wafer;

7   (d)   defining a point for each respective wafer in an N-dimensional space, where N=F*Z,

8   and each point has coordinates corresponding to values of the F failure metrics in each of the

9   Z zones of the corresponding wafer; and

10   (e)   clustering the sample of wafers into a plurality of clusters of wafers, so that the wafers

11   within each cluster are close to each other in the N-dimensional space, thereby identifying the

12   plurality of clusters of wafers from the sample of wafers so that within each individual

13   cluster, the wafers have a similar distribution of defects.

1   2.   The method of claim 1, wherein step (c) includes extracting the values from failure bit

2   map data, multi-probe data or final die sort data collected from each wafer, using a die sort

3   tester.

1   3.   The method of claim 1, wherein:

2   step (b) includes identifying Z reticle zones, corresponding to Z zones within a reticle

3   used to make each wafer,

4   each wafer has E reticle fields corresponding to E exposures of the wafer using the

5   reticle, and

6   step (c) includes providing, for each wafer, Z values for each failure metric, each of

7   the Z values representing a combined measure of the values of that failure metric for a given

8   one of the reticle zones across all E reticle fields of that wafer.

1   4.   The method of claim 3, wherein the D reticle zones correspond to D die within each

2   reticle field.

1   5.   The method of claim 1, wherein:

2   S spatial zones and R reticle zones are identified on each wafer, where R and S are

3   integers,

4   steps (c), (d) and (e) are performed with Z=S, using spatial data from the S spatial

5   zones, and

6   steps (c), (d) and (e) are performed with Z=R, using reticle data from the R reticle

7   zones.

1   6.   The method of claim 1, further comprising after step (d), filtering the data to eliminate

2   noise.

1   7.   The method of claim 1, further comprising after step (d),

2   performing a principle component analysis on the coordinates for each point to

3   identify a set of principle component scores;

4   identifying insignificant principal component scores; and

5   eliminating the insignificant principal component scores before step (e).

1   8.   The method of claim 7, wherein step (e) includes:

2   initially assigning each wafer to a respectively different cluster;

3   determining a respective distance between each pair of the clusters in a principle

4   component space; and

5   recursively combining into a single cluster the pair of clusters that are separated by a

6   smallest distance in the principle component space.

1   9.   The method of claim 7, wherein step (e) includes agglomerative hierarchical

2   clustering.

1   10.   The method of claim 9, wherein a distance between a given two of the clusters is

2   defined as the greatest distance, in the N-dimensional space, between any two wafers in the

3   given two clusters, and the agglomerative hierarchical clustering includes combining wafers

4   of the clusters until the smallest distance between any two of the clusters exceeds a

5   predetermined threshold.

1   11.   The method of claim 8, wherein the distance between a pair of clusters is defined as

2   the greatest distance between any two points corresponding to any of the wafers in the pair of

3   clusters.

1   12.   The method of claim 1, wherein step (e) comprises:

2   (e1)   initially assigning a subset of the wafers to one of the clusters;

3   (e2)   determining a respective distance between the point corresponding to each of the

4   subset of wafers and a centroid of the one cluster;

5   (e3)   calculating a first sum of the squared errors from the distances of step (e2);

6   (e4)   calculating a second sum of the squared errors that is obtained from each of two

7   partitioned clusters to be formed by partitioning the one cluster, where the second sum of the

8   squared errors is based on the respective distance between each point and a centroid of the

9   respective partitioned cluster to which that point is to be assigned;

10   (e5)   partitioning the one cluster into the two partitioned clusters, if the second sum of the

11   squared errors is significantly less than the first sum of the squared errors.

1   13.   The method of claim 12, wherein step (e5) comprises partitioning the one cluster into

2   the two partitioned clusters, if one minus a ratio of the second sum of the squared errors

3   divided by the first sum of the squared errors exceeds a threshold value.

1   14.   The method of claim 1, further comprising performing a commonality analysis to

2   identify one or more pieces of equipment responsible for a lot of wafers having a yield below

3   a desired yield.

1   15.   The method of claim 14, wherein the commonality analysis includes a Monte Carlo

2   simulation.

1   16.   The method of claim 14, wherein the commonality analysis includes analysis of

2   variance between lots of wafers.

AMENDED CLAIMS

1   1.   A method for analyzing a sample of wafers, comprising the steps of:

2   (a)   identifying F failure metrics that are applicable to at least one circuit pattern on each

3   wafer within the sample of wafers, where F is an integer;

4   (b)   identifying Z spatial and/or reticle zones on each wafer, where Z is an integer;

5   (c)   providing values for each of the F failure metrics, for each of the Z zones on each

6   wafer;

7   (d)   defining a point for each respective wafer in an N-dimensional space, where $N=F*Z$,

8   and each point has coordinates corresponding to values of the F failure metrics in each of the

9   Z zones of the corresponding wafer; and

10   (e)   clustering the sample of wafers into a plurality of clusters of wafers using a computer,

11   so that the wafers within each cluster are close to each other in the N-dimensional space,

12   thereby identifying the plurality of clusters of wafers from the sample of wafers so that within

13   each individual cluster, the wafers have a similar distribution of defects.

1   2.   The method of claim 1, wherein step (c) includes extracting the values from failure bit

2   map data, multi-probe data or final die sort data collected from each wafer, using a die sort

3   tester.

1   3.   The method of claim 1, wherein:

2   step (b) includes identifying Z reticle zones, corresponding to Z zones within a reticle

3   used to make each wafer,

4   each wafer has E reticle fields corresponding to E exposures of the wafer using the

5   reticle, and

6   step (c) includes providing, for each wafer, Z values for each failure metric, each of

7   the Z values representing a combined measure of the values of that failure metric for a given

8   one of the reticle zones across all E reticle fields of that wafer.

1   4.   The method of claim 3, wherein the D reticle zones correspond to D die within each

2   reticle field.

1   5.   The method of claim 1, wherein:

AMENDED SHEET (ARTICLE 19)